

INNOVATIVE TREND OF ACQUIRING AND MASTERING KNOWLEDGE BY STUDENTS

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ABSTRACT. With the beginning of the post-industrial epoch or knowledge society the problem of acquiring and mastering knowledge by future specialists stimulates great interest. It is explained by the fact that not only the role of knowledge but also the scheme of its mastering undergoes significant changes. Knowledge is considered to be the priority of the earth-dwellers of the XXI century along with the guarantor of the progressive development of states as well as their wealth.

The problem is being solved through working out of an educational class where knowledge acquiring and mastering would become of vital importance for students, the professional growth of future specialists would be held due to their natural abilities or capabilities and the personal qualities would be formed. It is emphasized that such classes have a new structure. We call them studactive classes. They differ from the ones that are already known (lectures, practical classes, laboratory work, seminars and other types of classes) by the specific organization of the entire pedagogical activity of all class participants, by the way of acquiring knowledge and the type of managing students' cognitive activity.

The macrostructure of the studactive class is researched, that is defined on the basis of providing active individual work of every student in the common process of acquisition and qualitative formation of competences that fosters natural communication of participants of studying, sharing the results of their work.

The scientific content, didactic functions, stages of individual formation and common principles of studactive classes organization are grounded. It is determined that the essence of the methodical aspect of organization of the studactive class lies in mastering active forms and methods of work both by a teacher in order to organize and provide help for students in overcoming difficulties and eliminating mistakes, and by future specialists for their self-cognitive activity taking into account their personality and subject specificity.

The organizational, educational and researching, social and psychological methods of stimulating future specialists, factors of providing efficiency of the studactive class are revealed. It is emphasized that the methods of mastering knowledge are based on the conscious independent acquiring new knowledge, forming a dynamic stereotype to self-improve and self-develop, drawing to a permanent active process to reveal knowledge. It is stated that different types of consultations for students with a low, medium and high level of preparation are used.

With the help of the method of mathematical statistics it is proved that studactive classes favour the level improvement of mastering knowledge by students.

1. INTRODUCTION

Since time immemorial, acquiring of knowledge was held according to the scheme: "one teacher – one student". Knowledge was transferred from a father to his son, from a grandfather to his grandson, from a mother to her daughter etc. Everything that the teacher knew had to be known in some time by his pupil who reproduced the exact copy of the things he was taught.

In the Medieval times, another scheme was applied: "one teacher – a group of students". It was considered that the student mastered the material when he was able to reproduce a phrase, a

formulae or a rule word for word after his teacher. Knowledge was transferred to many people at once. A similar idea was in the base of the process of acquiring knowledge by the class and lesson form of studying. A lot of time had passed when the mankind realized a significant difference between knowledge and skills. This trend may have been fostered largely by book-printing. Books became an available means of saving, accumulating and transferring knowledge for many people. Not only a person but also a book motivated for the process of thinking. Foundations of factories and plants may have influenced this trend as well. Anyway, industrialization created a demand on a large scale for people with new knowledge, skillful workers.

In the industrial society the scheme “one student – one teacher” was not appropriate as such people were necessary in a great quantity and within a short period of time. The traditional scheme “one teacher – a group of students” was not appropriate as well because according to it, a person gets knowledge but the skill to apply it in practice is not provided.

A well-known considerable contribution into acquiring knowledge was made by the university education, in particular a professional one. It is not necessary to reveal it. Some aspects are traced in [1]. From the end of the XX to the beginning of the XXI centuries university education changed radically. These changes were conditioned economically, socially, culturally and politically. Thousands of scientists argue that the post-industrial epoch has begun. Not only the scheme of acquiring knowledge but also its role is being changed: knowledge becomes the intellectual capital.

In the post-industrial period, the necessity emerged to obtain the fundamental theoretical knowledge, practical skills and acquired habits in the most economical way with minimum time and efforts required by both students and teachers. Along with this, knowledge gets older and graduates have to be able to learn and enlarge their knowledge during their professional activity. To solve this problem it is necessary to activate and intensify the educational process. When the terms “activation” and “active” are applied to the educational process, the question arises: Can studying be passive? The answer is: Yes, it can. In the modern pedagogy it is conventionally called a “traditional” one, with the role of students only as listeners. Like in earlier times, the traditional learning gives mostly knowledge, while students need skills and acquired habits of the future professional activity as well.

Research questions

The study was guided by the following research questions:

- In what way the level of mastering knowledge by students in the postindustrial epoch can be raised?
- In what way in the modern conditions skills and acquired habits of future specialists with due regards to their natural capabilities and employers' demands can be formed?
- What an educational class should be like to provide such mastering?

2. LITERATURE REVIEW

The fact that the new epoch is at its dawn was noticed as early as in 60-s of the previous century. D. Bell characterizes the post-industrial society in which there is a priority change in economics from production to giving services, and introduction of innovations depends more and more on achievements of the theoretical knowledge [2].

Many scientists give in to the scheme: production, enlargement and practical application of knowledge. Hence some new terms are created, such as “knowledge society”, used by R. Lane (1966) and in the course of time by D. Bell and others [3]. The work [4] deals with the names of scientists who worked out this concept in the XX century. The ability to learn how to learn is emphasized.

It is worth to analyze the different approaches to defining the notion “knowledge” not only by scientists but also its interpretations in dictionaries. Knowledge is the sum total of information in any sphere acquired in the process of studying, research etc. [5]. In some dictionaries knowledge is defined not only as the sum total of information but also as its understanding. For example, knowledge is understanding of or information about a subject which has been obtained by

experience or study, and which is either in a person's mind or possessed by people generally [6]. If in the beginning of the XVII century knowledge was considered to be a force (F. Bacon, 1597), then in the beginning of the XXI century knowledge equals to intellectual capital [6]. In [7] knowledge is referred to the most valuable treasure, the key to it is identified. In our research we will apply the terminology of the dictionary [8].

The results of the analysis of the latest research and publications testify the benefit of solving the problem of acquiring and mastering knowledge by which a receptive and reproductive type of the educational activity in universities is changed into an active, productive and researching one. Scientists reveal peculiarities, nature and essence of forming the activity, make analysis of its levels, define and classify methods of active learning. However there is a lack of specific methodology as for mastering knowledge which is not getting older with time.

Most often activation of the educational activity is considered as organization of perception of the educational material by students when knowledge mastering is held in the following way: comparison of new information with the one known before, revealing coherence between phenomena, generalization or specification of information, considering it from different points of view. In our opinion such an approach does not reveal fully the possibilities of activating students in class and mastering knowledge by them.

At the same time the formed knowledge does not allow the graduates to solve professional tasks in an original, creative way, realize their full potential as for the major professional obligations and qualities. An unsolved and still significant problem is the one which concerns studying oriented at creating conditions for the process of acquiring and mastering knowledge, formation of a high level of professional training, active aim-directed educational activity of students corresponding to their natural abilities and capabilities, self-perfection, maximal self-realization, feeling of success, obtaining assurance and support by formation their own trajectories of self-education. The problem outlined by us is defined by contradictions between considerable natural abilities of an individual and practical aim-directed activity in class of future specialists.

3. METHODOLOGY

The research was made in the context of the pedagogical paradigm characterized by a humanistic trend, professional training, drawing a student to the process of searching, value of collaboration, trust to cognitive abilities of all students, formation of special factors with regards to social identity of an individual, understandable explanation of new ideas, productive practical realization.

The research is directed at elaborating an educational class where acquiring and mastering of knowledge would be perceived by a student as a need of vital importance, the professional growth of future specialists would be held according to their natural abilities and capabilities, their personal qualities would be formed.

At the beginning of the experiment the preparation levels in the experimental and control groups practically did not differ. The quantity of students in those groups was 328 people in each. The students of the control groups were in a one-to-one manner put in correspondence with the students of the experimental groups. The numbered lists of the groups were composed and the state of the researched characteristics of students with the same numbers were compared.

For our case where mastering of knowledge by students is checked by the scale of appellation that has only two categories (present – absent), the Macnamara criterion to compare the results of two dependent selections is worked out. It is accepted to define one of the categories with a sign “1”, while the other one with the sign “0”.

Let us assume that the stochastic variable X characterizes the level of students' knowledge of the control groups, where teaching was held in a traditional way, and the stochastic variable Y characterizes the level of students' knowledge of the experimental groups by its measurement after implementation of the worked-out class. Two series of observations were obtained:

$x_1, x_2, \dots,$

y_1, y_2, \dots

of the same power that was equal to 328. As a result 328 couples of the type (x_i, y_i) were composed, where x_i are the meanings of the stochastic variable X , y_i meanings of the stochastic variable Y , $i=1,2,\dots,328$. It is evident that couples (x_i, y_i) can be only of four types: (1,1), (0,0), (0,1), (1,0). Exceptionally for the convenience of the explanation of the material we will consider that the meanings x_i were obtained by the control by the first time, and y_i – by the second time control.

The obtained data for clearness are filled into the Table 1.

Table 1
Researched Characteristics Data

<i>a</i> $x_i=1, y_i=1$	<i>b</i> $x_i=1, y_i=0$
<i>c</i> $x_i=0, y_i=1$	<i>d</i> $x_i=0, y_i=0$

In Table 1 the meaning *a* is equal to the quantity of students who confirmed twice the positive level of knowledge. The meaning *b* equals to the quantity of students, who confirmed their knowledge level at the first time, but demonstrated a worse level at the second time. The meaning *c* is of the quantity of students who improved the knowledge level at the second time. The meaning *d* equals to the quantity of students who were absent twice or demonstrated twice the low level of knowledge.

The correctness of the application of the criterion is provided by fulfilling all its requirements. Firstly, the selection is representative as it was realized accidentally. Secondly, the selections are dependent as one-to-one correspondence is settled between them. Thirdly, the couples (x_i, y_i) are mutually independent as the members of the selections do not influence each other, besides, the possibility of their communicating or contacting is eliminated. Finally, the measurement scale is the scale of appellation with two categories.

We will assume that the laws of distribution of stochastic variables X and Y are the same. Then the corresponding probabilities are equal, namely for all 328 couples the equality is realized:

$$P(x_i=0, y_i=1) = P(x_i=1, y_i=0).$$

Hence, the null hypothesis H_0 presents the following:

$$H_0: P(x_i=0, y_i=1) = P(x_i=1, y_i=0), \text{ for each } i.$$

As an alternative hypothesis H_1 the hypothesis is chosen:

$$H_1: P(x_i=0, y_i=1) \neq P(x_i=1, y_i=0).$$

That is why the null hypothesis was checked: the application of the studactive classes does not change the level of knowledge mastering by students. The alternative hypothesis was: the application of the studactive classes changes the level of knowledge mastering by students.

To check the hypothesis the statistics of the criterion T was calculated by the formula:

$$T = \frac{(c-b)^2}{c+b}.$$

For a significance level a variable was chosen $\alpha=0,05$, which is commonly assumed in the pedagogical research. After comparison of the calculated meaning T with the corresponding critical meaning a conclusion is drawn about adoption of the null hypothesis or its refusal.

By the refusal of H_0 a hypothesis H_1 is adopted:

$P(x_i=0, y_i=1) < P(x_i=1, y_i=0)$, if $c < b$,
 or
 $P(x_i=0, y_i=1) > P(x_i=1, y_i=0)$, if $c > b$.

4. DISCUSSIONS AND RESULTS

It is proved that the academic performance after mastering knowledge is much higher when creative abilities, individual temperament, sincerity of a future specialist who becomes a co-author of the class, are developed simultaneously. Studying orientated at aim-directed systematic self-realization, provides a single entity in the unity of intellectual, humane and physical development. Such classes have a new structure thus we take the responsibility for outlining a new type of an educational class – a studactive one. Its name is grounded by the real educational activity of students.

The studactive class is an educational class where a progredient active creative individual acquiring knowledge by students in coherence with self-reflection, self-improvement, self-realization under the influence of collegiality, is realized. The class encompasses the following major stages: corrective, educational, practical and controlling, diagnostic and analyzing one. The educative and cognitive activity begins to be formed even before the class, when the students' prior learning experience in the previous topic or topics is checked. Besides consultations for students by leaders of microgroups, co-fellows or teachers are provided.

In the process of specialists training at studactive classes the aim is formulated. It lies in active creative studying of a topic through formation students' ability to see the problem individually, define the means of its practical solution. That means that during acquiring knowledge students need to be researchers of the things that are already researched, to advance hypotheses, to find the ways of their check-up, to compose and solve problematic and professional tasks etc. The acquired theoretical material is consolidated at ones by practical habits.

The core essence of the studactive class is communicative actions of students. In the process of its realization not only the system of mastering a new educational material but also thoughts that express convictions of an individuals' cognition, their social humane feelings which are developed on the basis of knowledge and individual thinking, are revealed. At such classes the educational and up-bringing process is built on the democratic grounds and includes four major components:

- socially considerable motives and professionally valued interests;
- motivated emotional and will aspirations to enlarging and extending knowledge, creation of the scientific base for self-education;
- communicative;
- activity and practical one.

Our research has shown that students' active work at studactive classes – is the base where really mastered knowledge is kept, formation, self-improvement, self-approval of a future specialist is held, self-development of students' creative qualities, their ability to perceive, analyze and use new scientific ideas in conditions of individual professional work are realized. Individual learning, comprehension of knowledge necessity and the need to supplement it constantly is a decisive step towards life-learning.

Organizational, educational and researching, social and psychological methods of stimulating future specialists, factors of providing efficiency of the studactive class are revealed. The orientating structure of the methodical recommendations for the guided individual out-of-class work may contain the following sections:

1. A list of recommended literature.
2. Urgency of the topic (meaning for professional activity, inter-subject connections).
3. A list of the main terms on the topic to be mastered by students.
4. Realization of the educational material in accordance with the plan by students.
5. Comparative analysis of the studied educational material and the one acquired earlier, comprehension of inner regularities, doing cognitive tasks for self-preparation and self-estimation.

6. Educational tasks for self-correction of the initial level of knowledge and skills.
7. Creative process of generalization and systematization of knowledge, skills and acquired habits in the topic: composing questions for group-mates, tasks, graphs, schemes etc as well as brain-rings, crossword-puzzles, tests, control tasks.
8. Self-estimation as for comprehension of a topic.

The active work of a student is realized by:

- studying a new material,
- composing tasks, questions etc.
- analyzing answers,
- estimating knowledge etc.

It is proved that the methodic aspect of the organization of the studactive class lies in mastering active forms and methods of work both by a teacher for organizing and giving help to students in overcoming difficulties and eliminating mistakes, and by a future specialist for self-cognitive activity taking into account their individuality and subject specificity. To realize it, the latest achievements of science are used, equal conditions for development of a personality, creative self-realization of each student, free exchange of thoughts, the atmosphere of psychological liberation, friendliness, mutual aid and control, are created.

At studactive classes vivid discussions have become a proof of the real mastering of knowledge. Namely through knowledge which is grounded on the identification research and belief, one can actively favour the productive professional learning, development of uninterrupted learning, formation of the level of professional training in correspondence with employers' demand. At such a class a student's activity on the basis of the individual educational needs reveals the possibilities of an individual to the full extent, furthers harmonic formation of mental and moral qualities. The studactive class reflects the process of formation and development of future specialists, where their civil traits are displayed. At the studactive class students defend their thoughts in a creative self-development, compare the opposite positions, prove advantages of their suggestions and disadvantages of their opponents, consider the problem from different angles, choose the convincing argumentation for proofs or disproofs, doubt, learn how to speak, listen to others and interact with anybody. Such form of work promotes non-formal mastering of knowledge, and the process of studying becomes a sense of life for students (they speak about it not only in class).

At such classes knowledge is mastered through persuasion. Professional training in universities provides formation of special knowledge as a result of generalizing of the common work of the mankind. The formed knowledge without convictions which are inherent only to an individual consciousness, is not always subjectively valuable and significant. Formation of individual inner convictions, needs, possibilities which appear on the basis of the scientific knowledge, are grounded on the development of thinking and feelings directed at a cognitive, communicative, self-improving creative activity. Studactive classes make the grounds for self-education, further professional perfection, differ with new active types of activity of a teacher and a student.

The methods of mastering knowledge are based on the conscious individual acquiring of new knowledge, formation of the dynamic stereotype to self-improve, self-develop, drawing to a constant active process of discovery, research of the things researched before. Different types of consultations are used for students of a low, medium and high level of preparation.

The macrostructure of a studactive class is grounded. It is defined on the basis of provision of active individual work of each student in the unified process of obtaining and qualitative formation of competences that allows to provide natural communication for the participants of the educational process, share the results of their work. The educative, integrative and differentiating, communicative, controlling, correcting, professional and guiding, psychological, developing, self-actualizing, strategic didactic functions of the studactive class and the stages of formation of an individual by that are revealed.

On the basis of the research of the didactic functions, common principles of studactive classes organization, their scientific content as well as comparison of all types of educational classes, the conclusion is drawn that they differ from the ones known before (lectures, practical classes, laboratory work and other kinds of classes). This difference lies in the specific organization of the whole pedagogical activity of all class participants, the way of obtaining competences of a future specialist, the type of management of the cognitive activity.

By Macnamara's method it is proved that studactive classes further the rise in acquiring knowledge by students. In conditions of the given experiment the data are received which are filled into the Table 2.

Table 2
Data of Level of Mastering Knowledge by Students

$a=232$	$b=25$
$c=47$	$d=24$

As $b+c=72>20$, then having calculated the criterion statistics we have the variable:

$$T = \frac{(c-b)^2}{c+b} = \frac{(47-25)^2}{47+25} = 6,72.$$

For the level of significance $\alpha = 0,05$ the critical meaning $T_{cr}=3,84$. In accordance with statistics approximation of the distribution criterion T by distribution χ^2 with one degree of freedom, we have $T > T_{cr}$ and decline the null hypothesis at the significance level 5 %. So the null hypothesis is adopted. As $c > b$, then the following hypothesis is adopted:

$$P(x_i=0, y_i=1) > P(x_i=1, y_i=0).$$

Thus the implementation of studactive classes into the educational process does not only change the level of mastering knowledge by students but also improves it.

5. CONCLUSION

A new type of educational classes is elaborated, during which the following points are realized:

- a new developing interaction in the process of unity of acquiring theoretical knowledge and forming skills and acquired habits of its practical individual application;
- implementation of a new form of productive aim-directed activity of class participants whose main feature is free communication, creative self-expression and self-improvement with students' personal responsibility for the results of their work;
- formation of leader qualities and of the production head;
- forming their own style of behavior which will influence the adaptation to a new environment in a positive way and will be defined by rules and norms of labour activity;
- correlation of the teacher activity with individual peculiarities of a student without stressful factors which cause negativisms of different types as well as depressive passiveness;
- democratic collegial management of the pedagogical process;
- permanent monitoring of knowledge quality of future specialists that becomes the most valuable treasure;
- the entire system of the up-bringing influence along with the usage of the fullest potential of high school.

Such educational classes we called studactive in a well-grounded way.

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